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BLUE FLIGHT COVERALL PROGRAM

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Presently used Flight Coveralls (CWU-27/P) are sage green. New Coveralls were manufactured from blue aramid to provide for a choice in color. These suits were given a special evaluation by operational squadrons. Although the suits were made from a heavy gabardine (the only fabric available in blue at the time of manufacture) which was somewhat uncomfortable in hot weather, the Coverall in general was satisfactory. A proposal is now being evaluated to manufacture and retest Coveralls using a lighter weight blue fabric.

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BACKGROUND

The Blue Flight Coverall is to be provided to supplement the presently used sage green CWU-27/P coverall (MIL-C-83141) which is worn as an outer garment with various protective under-garments. The Blue Flight Coverall will be worn on certain missions, as desired by the Squadron Commanding Officers. It enhances military appearance and will be compatible with current flight and survival equipments.

DESCRIPTION

The first configurations of the Blue Flight Coverall are shown in figure 1. Type I was manufactured from Nomex Aramid III, while the Type II coverall was manufactured from Nomex I which was calendered to give it sheen. The final configuration is shown in figure 2, manufactured from 6½ oz. per yard Nomex Aramid III fabric. The Blue Flight coverall is designed with some improvements to the CWU-27/P. The aramid fabric in the Type I coverall was heavier than the CWU-27/P fabric because of availability problems with lightweight piece dyed fabrics. A flap was added to the pencil pocket on the left sleeve as shown in figure 2. Epaulets were added to be used with soft shoulder boards, which are shown in figure 3.

TEST PROCEDURE

Thirty suits were distributed to two A-7E squadrons: VA-82 and VA-146. These were to be worn by pilots during their regular flight and in-between flight duties. Questionnaires were forwarded to each squadron to be filled out by each pilot after a period of wear with intermediate launderings by each pilot. The questionnaire is shown in appendix A. The suits were to be machine washed and dried at home or laundered where possible.

RESULTS AND DISCUSSION

GENERAL

Fourteen completed questionnaires were received from the pilots in VA-146 who wore their suits in June and July. Sixteen completed questionnaires were received from the pilots in VA-82 who wore their suits in July and August. Results of the questionnaires are summarized in appendix B.

CONDITIONS OF WEAR

Both squadrons wore their suits in relatively hot weather and fairly humid conditions. Temperatures reached a maximum of 105°F with an average temperature of 80-81°F. Humidity reached a maximum of 92% with an average of between 66-73%. However, VA-82 pilots wore their suits for an average of 200 hours (50 hours minimum, 500-hour maximum) while VA-146 pilots wore their suits for an average of 51 hours (6-hour minimum, 200-hour maximum).

Figure 1. Blue Flight Coveralls

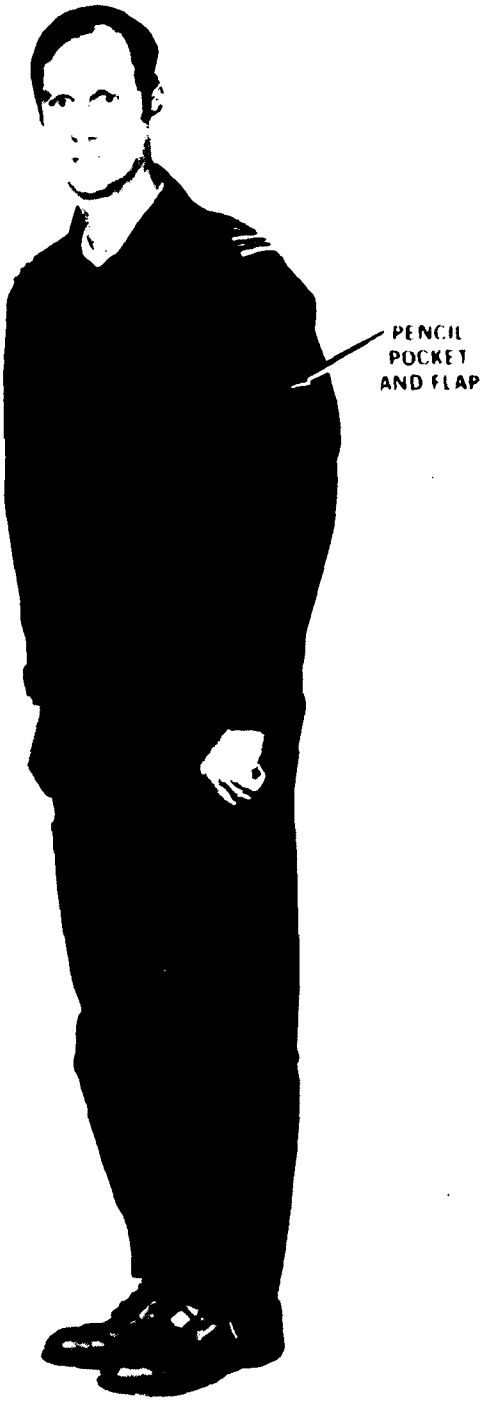

Figure 2. Blue Flight Coverall (Final Configuration)

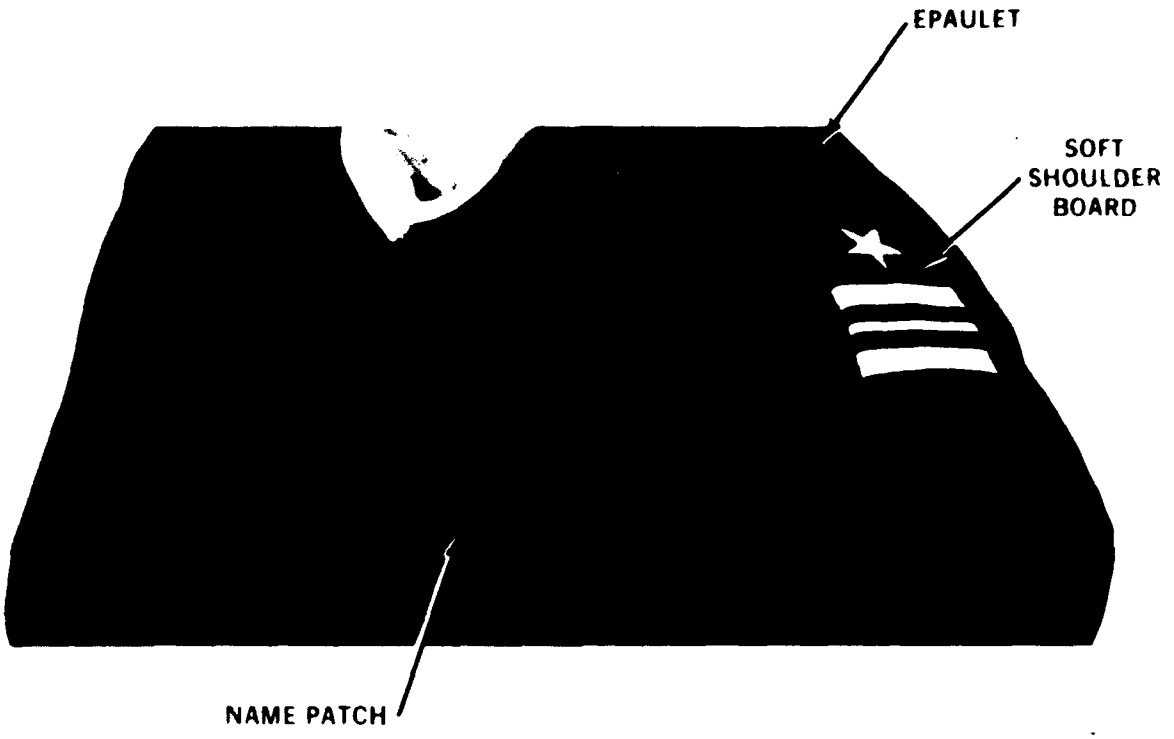

Figure 3. Additions to Coverall

LAUNDERING

The number of launderings varied from 1 to 60 for both groups of pilots with an average of 8½-10 hours of wear for each time a suit was laundered.

The greatest problem was with seam puckering which occurred in half of the garments. All other problems (shrinkage, pilling, staining, sagging or fabric or seam failures) were relatively minor. One group reported some instances of static electricity buildup while the other group reported none.

COMFORT

Dissipation of Perspiration

VA-82 pilots indicated that the suits were fair to very poor in this respect while VA-146 pilots indications were good to poor. These rather unfavorable results may have been due to the heavy fabric used (see "WEIGHT", below).

Mobility

VA-82 pilots indications that mobility, in general, was poor while VA-146 pilots said that mobility was very good.

Compatibility with Other Flight Gear

VA-82 pilots considered compatibility with other flight gear was fair while VA-146 pilots considered compatibility from good to very good.

Overall Design

The overall design, in the opinion of VA-82 pilots, was considered fair to very poor whereas VA-146 pilots considered the design good to very good.

Comparison with CWU-27/P

The VA-82 pilots considered the blue suit poor as compared with the CWU-27/P, while the VA-146 pilots, in general, considered the blue suit good as compared with the CWU/27P.

WEIGHT

A great majority of the pilots considered the suit too heavy. The suit was manufactured from 6.5 oz/yd^2 "Gabardine" fabric because it was the only fabric of this color commercially available.

COLOR CHOICE

Opinion was about evenly divided as to the choice of the blue color.

EPAULET AND SHOULDER BOARD

Almost all the pilots considered this design a desirable feature.

PENCIL POCKET AND FLAP

Although the majority of the pilots liked the pencil pocket, the greatest complaint was that the flap was too low, thus making it difficult to insert pens and pencils.

ZIPPER

In many cases, the flaps around the zippers puckered after wear and launderings.

DESIGN TO BE ADOPTED

The two groups split. The majority of VA-82 said "No" while VA-146 pilots said "Yes".

CONCLUSIONS

In general, it may be concluded that if the weight of the suit fabric was reduced, the blue suit would be quite suitable except for minor modifications. Zipper enclosure design could be improved and pencil pocket design can be changed. The overall weight of the suit probably contributed to the negative feelings about perspiration dissipation, mobility, overall design and comparison with the CWU-27/P. Opinion on color was split. The Blue Flight suit will be used as an option to the current sage green garment and will be chosen for flight use by Squadron Commanders.

An Engineering Change Proposal (ECP) was prepared by NAVAIRDEVCEN (603312) to examine the use of lighter weight fabrics (4.3 oz/yd^2) using both color sealed yarns and dyed fabric for this application. Pending approval and funding from NAVAIR for the ECP, this first phase of this program has been completed.

APPENDIX A

NAVAL AIR DEVELOPMENT CENTER
EXPERIMENTAL BLUE FLIGHT SUIT EVALUATION FORM

Name and Rank: _____ Date: _____

Organization/Squadron: _____

Aircraft Type: _____

Crew Position: _____

1. Size of experimental coverall issued for evaluation: _____

2. Type of coverall normally worn: _____

3. Size of coverall normally worn: _____

4. What underclothing was worn during the test period?
   a. Undershirt (sleeveless)
   b. T-Shirt _____
   c. Boxer Shorts _____
   d. Jockey Shorts _____
   e. Other _____

5. Approximate total hours worn, up until the time you filled out this evaluation form: _____

6. Number of times laundered during this evaluation period, if none mark 0: _____

7. After laundering, did you notice any of the following?

a.	Puckering of seams	Yes ( )	No ( )
b.	Shrinkage	Yes ( )	No ( )
c.	Pilling (small balls on surface)	Yes ( )	No ( )
d.	Stains or spots	Yes ( )	No ( )
e.	Stretching or sagging	Yes ( )	No ( )

If yes, please identify the location(s): _____

8. Did any failures of the fabric or seams occur during the test?

   Yes ( ) No ( ) If yes, briefly describe the failure (tear, hole, excessive abrasion, broken stitching, etc.) and the location. Also, state if accidental or due to normal use: _____

   _____

   _____

9. Was any static electricity noticed?

   Yes ( ) No ( ) If yes, was it objectionable? Yes ( ) No ( )

10. What was the ambient temperatures during the evaluation?

    a. Highest _____ Lowest _____ Average _____

    What was the ambient humidity level during the evaluation?

    b. Highest _____ Lowest _____ Average _____

11. Did you like the epaulets for the soft shoulder boards? Yes ( ) No ( )

    Explain: _____

    _____

    _____

    _____

12. Did you like the pencil pocket flap? Yes ( ) No ( )

    Explain: _____

    _____

    _____

    _____

INSTRUCTIONS

For the following questions, it is requested that only one response be marked. Circle the response that best expresses your opinion. Any additional comments or explanations would be appreciated in the space provided on the last page.

		Very Good				Very Poor
13.	How well did the suit dissipate perspiration for the highest ambient humidity level to which you were exposed during the evaluation period?	1	2	3	4	5
14.	Rate the overall design of the experimental coverall?	1	2	3	4	5
15.	How compatible was the experimental flight coverall with other flight gear?	1	2	3	4	5
16.	How would you rate your overall mobility while wearing the experimental coverall?	1	2	3	4	5
17.	How would you rate the experimental coverall relative to other standard coveralls you currently use?	1	2	3	4	5

18. Do you recommend this experimental coverall be adopted? Yes ( ) No ( )
If not, why? _____

19. List any additional comments or suggestions which may be beneficial to this evaluation. _____

A-7E AIRCRAFT	VA-82	VA-146
CONDITIONS UNDER WHICH WORN		
AMBIENT TEMP		
Average Max	105°F	101°F
Average Low	60°F	55°F
Average	81°F	80°F
HUMIDITY		
Average Max	92%	89%
Average Low	45%	24%
Average	66%	73%
LAUNDERING AND WEAR		
HOURS WORN	50-500 Average 200	6-200 Average 51
NO. OF LAUNDERINGS	10-60 Average 21	1-14 Average 6
Hours Worn/Laundering	10	8½
Seam Puckering	50% Yes	50% Yes
Shrinkage, Pilling, Stain, Sag	12% Yes	2% Yes
Fabric, Seam Failures	None	8% Yes
Static Electricity	None	17% Yes

COMFORT ESTIMATE (in % of respondents)

	Very Good	Good	Fair	Poor	Very Poor	Very Good	Good	Fair	Poor	Very Poor
Dissipate Perspiration			44	6	50		38	38	24	
Mobility		33	20	40	7	58	21	21		
Compatibility with Flight Gear	19	13	38	25	5	36	57		7	
Overall Design	6	13	25	25	31	36	50	14		
Comparison with CWU-27/P		25	19	6	50	21	42	16	21	

GENERAL OPINIONS		
WEIGHT	75%: Too Heavy	72%: Too Heavy
COLOR CHOICE	60% Good; 40% Poor	40% Good; 60% Poor
EPAULET	88% Satisfactory	79% Satisfactory
PENCIL POCKET AND FLAP	56% OK; 44% Poor	79% OK; 21% Poor
ZIPPER	38%: Zipper flaps puckered	79%: Zipper flaps puckered
SHOULD THIS DESIGN BE ADOPTED?	33% Yes; 67% No	86% Yes; 14% No

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